LIGHT AND WEATHER RESISTANCE SENSING SYSTEM WITH A SENSED SIGNAL TRANSMISSION CHANNEL

Cross reference to related application, assigned to the assignee of the present application, the disclosure of which is hereby incorporated by reference: U.S. Ser. No. 587,826, filed Mar. 9, 1984, STURM et al "SENSOR FOR TESTING LIGHT AND WEATHER RESISTANCE OF SAMPLES".

The present invention relates generally to systems for measuring the light and weather resistance of samples of various materials, and more particularly to systems placed in the simulation or test chamber with the samples for measuring the amount of radiation and other simulated environmental influences to which the samples are being subjected.

BACKGROUND

There is disclosed in sales leaflet No. D 310 608/2 C 5.82/N Ku of the Original Hanau division of Heraeus GmbH, a German company, a light and weather resistance testing apparatus equipped with an ultraviolet radiation measuring device. This apparatus includes a sensor which is disposed in the plane of the samples and moves with them, a watertight housing with an optical system, a radiation receptor, an integrator, a memory and a power supply consisting of two 9 V batteries. The radiation receptor permits wavelength measurements in the range from 300 to 400 nm (nanometers). When the rotation of the samples is stopped, the sensor is connected by means of a cable to a read-out apparatus external to the weathering chamber. This read-out device then permits the display of the instantaneous values of the irradiance or momentary radiation intensity (milli-watts/sq. cm) and irradiance or radiation dose (in watt-seconds/sq. cm).

THE INVENTION

It is an object to permit precise measurement of various spectral ranges in a weathering apparatus. It is a further object to permit this measurement to be done continuously during movement of the samples.

Briefly, the testing apparatus of the present invention includes a sensor having multiple receptor cells for the various respective spectral ranges to be measured, and a transmitter for wireless transmission of signals representing the measurements. The sensor preferably has solar cells attached to it as a source of electrical energy. It is advantageous to provide a signal receiver for the central transmitter in the form of an antenna which projects into the sample chamber of the apparatus from the housing wall. Preferably, the antenna is connected by a cable to a socket disposed in the housing wall for connection to a plotter and display unit. The transmitter is preferably also connected to a temperature measurement sensor disposed in the plane of the samples.

DRAWINGS

FIG. 1 is a schematic cross-sectional view of the light and weather resistance testing apparatus of the present invention;

FIG. 2 is a cross-sectional view of the sensor portion of the apparatus;

FIG. 3 is a schematic view of the front panel of the plotter unit of the invention; and

FIG. 4 is a block diagram of the signal collection, transmission and display system.

DETAILED DESCRIPTION

As shown in FIG. **1**, the light and weather resistance testing apparatus **9** has a testing chamber **10** in which samples **14** are rotatably disposed. In the plane of the samples, a sensor **1** is located so as to be subjected to exactly the same radiation from the lamps **2** as the samples **14**. A signal receiver in the form of an antenna **3**, such as a ring antenna or rod antenna, is disposed on the housing wall **8** and projects into the sample chamber **10**. The antenna **3** is connected by means of a cable **11** with a plug socket **12** disposed on the outer face of the housing wall **8** for connection to a plotter unit **13**.

As shown in FIG. **2**, the sensor **1** comprises a cylindrical housing **19** having a metallic closure **16** separated by packing or gaskets from a light-transmitting quartz-glass tube **15**. To reduce general heat loading of the sensor, the interior surface of the quartz-glass tube **15** is provided with an infrared radiation filtering coating or layer which, however, transmits sufficient heat waves from the lamps to drive solar cells **7**. In a preferred embodiment, six receptor cells **6** are arranged in a row in the tube **15** and serve to receive respectively six different spectral ranges. The preferred wavelength ranges are partial ultraviolet ranges of from 300 to 320 nm, from 330 to 350 nm, from 355 to 375 nm, and from 380 to 400 nm, a complete ultraviolet range from 300 to 400 nm, and a comprehensive range (hereinafter referred as "the global range"), including both visible light and ultraviolet light, of from 300 to 800 nm. 1 nm = 1 mμ = 10 Å. Most visible light falls in the violet to red range of from 4000 to 7000 Å, or 400–700 nm.

The sensor housing also has provision for a connection to a temperature measurement sensor **6***t*. The temperature sensor is adapted to measure the black panel temperature and is preferably disposed in the plane of the samples. Inside the sensor are disposed solar cells **7** for power supply and electronic circuits for transmission of the signals resulting from the radiation.

FIG. **3** illustrates the front panel of the plotter unit **13**. The plotter **13** has a display **17**, an irradiation selector **20**, a key switch **18** with multiple positions for selection of wavelength range and for establishing of the required connection, six keys **21** for selection of irradiance in the respective wavelength ranges, a temperature key **22**, a key **23** for display of the irradiation dose for the entire ultraviolet range and a key **24** for display of irradiance.

FIG. **4** is a block diagram of the apparatus for the measurement and display of the irradiation data. During the testing of the samples **14** in the sample chamber **10**, the sensor **1** receives the radiation given off by the lamps **2** and converts the radiation into electrical signals by means of receptor cells **6**. As previously described, power is supplied by the solar cells **7** by conversion of the same radiation. The receptor cells are interrogated, producing signals, corresponding to the radiation, which are combined in multiplexer **25** and subsequently transmitted serially by frequency modulation in the transmitter **4**. The signals received in the receiver **5** are directed to a demodulating demultiplexer **26**. With the help of a switch associated with keyboard **21**, a signal corresponding selectively to one of the six spectral ranges or to the temperature can be fed to the instantaneous value circuit **27**. With the help of the keyswitch **18'** and the multiplexer **35**, a signal corresponding to the ultraviolet spectral range or to the global range can be